

IN THE DRAWINGS:

The attached replacement sheet of drawings includes changes to Figs. 8B, 8C, and 8D. The replacement sheet, which includes Figs. 8A-8D, replaces the original sheet including Figs. 8A-8D. In Figs. 8B, 8C and 8D, the spelling of "Si-handle water" has been corrected to read "Si-handle wafer."

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

REMARKS

This is intended as a full and complete response to the Office Action dated April 20, 2005, having a shortened statutory period for response extended one month to expire on August 22, 2005. Please reconsider the claims pending in the application for reasons discussed below.

In the specification, the paragraphs [0039], [0049], [0051], [0052] and [0073] have been amended to correct minor editorial problems.

In the drawings, the term "Si-handle water" in Figs. 8B, 8C, and 8D has been corrected to read "Si-handle wafer."

Claims 1-19 remain pending in the application and are shown above. Claims 14-19 have been canceled by the Applicants. The Applicants reserve the right to file divisional and/or continuation applications to continue prosecution of the subject matter. Claims 1-13 are rejected. Reconsideration of the rejected claims is requested for reasons presented below.

New claims 20-26 have been added. Applicants submit that these new claims do not introduce new matter.

Claims 11 and 12 are amended to correct matters of form. Claims 1 and 13 are amended to clarify the invention. These amendments are not presented to distinguish a reference, thus, the claims as amended are entitled to a full range of equivalents if not previously amended to distinguish a reference.

I. Rejection of Claims 1-13 Under 35 U.S.C. §103(a) – AAPA in view of Sferlazzo et al.

Claims 1-13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Applicants' admitted prior art ("AAPA") and Sferlazzo et al. (U.S. 5,523,652; issued Jun. 4, 1996). Applicants respectfully traverse the rejection.

The Examiner states that Applicants admit the process of producing ions in a microwave plasma in the presence of a magnetic field to have been known prior to Applicants' invention. The Examiner further states that Applicants admit implantation of hydrogen ions in a smart-cut method and implantation of B ions with mass number 11 at

less than 1 keV to have been known. Applicants do not admit the aligning of a magnetic field with the extraction direction of ions to have been performed to create the ion beam in the above process.

The Examiner further states that Sferlazzo et al. discloses in column 7 aligning the magnetic field within a microwave plasma generation chamber with cap arc slit 64 so that a greater proportion of the generated ions will be made available for extraction through the arc slit 64.

As pertaining to claims 1-12, Applicants submit that neither AAPA nor Sferlazzo et al. teaches or suggests modifying the method of AAPA with the apparatus of Sferlazzo et al. to yield the subject matter of claim 1, and claims 2-12 dependent thereon. Sferlazzo et al also fails to teach, show or suggest using its apparatus for implanting ions in SOI wafers.

As pertaining to dependent claim 2, Sferlazzo et al. states that “[t]he element(s) chosen for vaporization may include phosphorous (P), arsenic (As) and antimony (Sb).” (col. 7: lines 35-37) All of these ions have an atomic mass greater than 30 amu. Sferlazzo never suggests using its apparatus for implanting ions wherein the mass number of the ions is 20 or lower as recited in Applicants’ claim 2.

Further, as pertaining to dependent claim 9, Sferlazzo et al. fails to teach, show or suggest the non-ECR conditions represented by claims 3 and 4. Sferlazzo, et al. teaches producing “an electron cyclotron resonance frequency condition in the plasma chamber. At the electron cyclotron resonance frequency, free electrons in the plasma chamber interior region 50 are energized to levels up to ten times greater than the energy levels in conventional plasma discharge and facilitates striking an arc in the interior region.” (col. 5: lines 55-60) Thus, Sferlazzo et al. operates in ECR conditions, unlike the non-ECR conditions represented by equations (3) and (4) in Applicants’ claim 9.

Therefore, AAPA in view of Sferlazzo et al. fails to teach, show or suggest modifying the method of AAPA with the apparatus of Sferlazzo et al. to yield the subject matter of claim 1, and claims 2-12 dependent thereon. Further, AAPA in view of Sferlazzo et al. fails to teach, show or suggest the use of non-ECR conditions as recited

in Applicants' claim 9. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 1 and claims 2-12 dependent thereon.

As pertaining to claim 13, neither AAPA nor Sferlazzo et al., teaches implanting more than 50% hydrogen molecular ions as recited in Applicants claim 13. Applicants admitted prior art states that "[a]ccording to the smart cut method, an SOI wafer is manufactured by implanting *hydrogen ions* in a Si substrate through an insulating layer (SiO₂ layer or the like) formed on a surface of the Si substrate." (U.S. Pat. App. Pub. 2004/0038505 at [0005]; emphasis added). Applicants further elaborate on this point by stating that "[i]n the conventional method . . . hydrogen atoms are generated more easily than hydrogen molecular ions, hydrogen atoms are almost used exclusively for ion implantation. On the other hand, according to the ion implantation method of the present invention . . . a rate of hydrogen molecular ions in the plasma can be dramatically increased compared to the conventional method. Therefore, high-level throughput, which was difficult to be achieved conventionally, can be easily realized." (U.S. Pat. App. Pub. 2004/0038505 at [0075]). Thus the AAPA focuses on implanting hydrogen ions whereas claim 13 focuses on implanting hydrogen molecular ions which achieves higher throughput.

Sferlazzo et al. teaches that "[t]he element(s) chosen for vaporization may include phosphorous (P), arsenic (As) and antimony (Sb)." (col. 7: lines 35-37) Thus Sferlazzo et al. never teaches the implantation of hydrogen molecular ions. As a result, the AAPA in combination with Sferlazzo et al. fails to teach, show or suggest implanting more than 50% hydrogen molecular ions as recited in Applicants' amended independent claim 13.

Therefore, AAPA in view of Sferlazzo et al. fails to teach, show or suggest exciting a hydrogen gas with a with a microwave in a pressure-reduced chamber to generate plasma containing more than 50% hydrogen molecular ions as recited in claim 13, and new claims 20-26 dependent thereon. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 13 and new claims 20-26 dependent thereon.

II. Rejection of Claims 1-13 Under 35 U.S.C. §103(a) – AAPA in view of Ichimura et al.

Claims 1-13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of AAPA and Ichimura et al. (U.S. 5,620,522; issued Apr. 15, 1997). Applicants respectfully traverse the rejection.

The Examiner states that Ichimura et al., discloses in Figure 4 aligning magnetic field with the extraction direction of ions using magnets 3 in a microwave plasma generator.

As pertaining to claims 1-12, neither AAPA nor Ichimura et al. teaches or suggests modifying the smart cut method of AAPA with the apparatus of Ichimura et al. to yield the subject matter of claim 1, and claims 2-12 dependent thereon. Ichimura et al. teaches “a microwave plasma generator with a small-sized permanent magnet and usable certainly in the aim of fabricating magnetic films, and can generate stable plasma which is uniform in a wide range.” (col. 2: lines 5-9). Ichimura et al. does not teach, show or suggest using the apparatus for ion implantation in semiconductor devices such as SOI wafers.

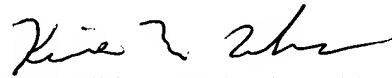
Therefore, the AAPA in view of Ichimura et al., fails to teach or suggest modifying the method of AAPA with the apparatus of Ichimura et al. to yield the subject matter of claim 1, and claims 2-12 dependent thereon. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 1 and claims 2-12 dependent thereon.

As pertaining to claim 13, neither AAPA nor Ichimura et al., teaches implanting more than 50% hydrogen molecular ions as recited in Applicants' independent claim 13. As discussed above, AAPA fails to teach, show or suggest implanting more than 50% hydrogen molecular ions as recited in Applicants' independent claim 13. As stated by the Examiner, Ichimura et al. disclosed in figure 4 aligning magnetic field with the extraction direction of ions using magnets 3 in a microwave plasma generator. Ichimura et al. makes no mention of implanting hydrogen molecular ions in silicon substrates. As a result, the AAPA in combination with Ichimura et al. fails to teach, show or suggest implanting more than 50% hydrogen molecular ions as recited in Applicants' amended independent claim 13.

Therefore, AAPA in view of Ichimura et al. fails to teach, show or suggest modifying the method of AAPA with the apparatus of Ichimura et al. to yield the subject matter of claim 13, and new claims 20-26 dependent thereon. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of claim 13 and new claims 20-26 dependent thereon.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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Fig.8A

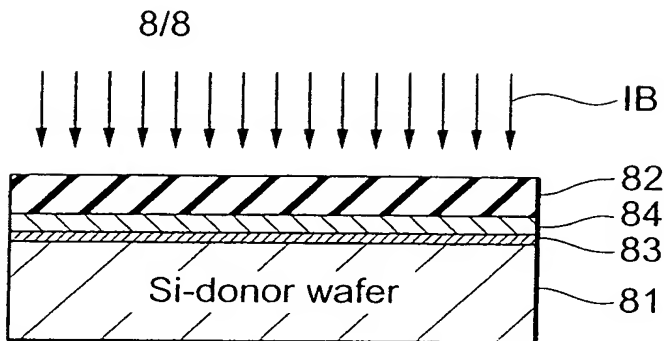


Fig.8B

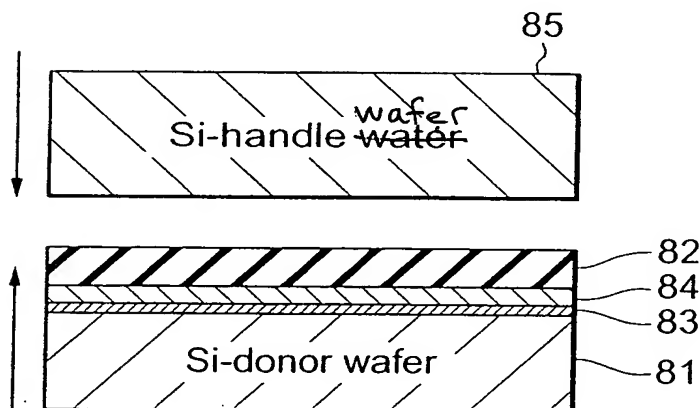


Fig.8C

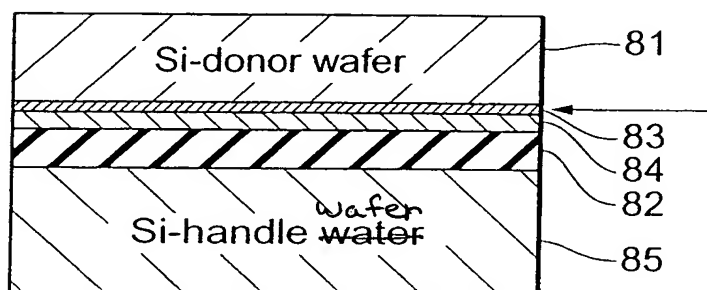


Fig.8D

